“Elephant Toothpaste” (Yeast + Hydrogen Peroxide Experiment)

Materials Needed:

- Hydrogen peroxide (H2O2)
- Water
- Food coloring
- Experiment safe container
- Instant Yeast packet
- Dish soap (optional)

Methods:

Obtain a glass beaker or lab safe container. Place a small amount (few oz) of hydrogen peroxide in the container. What happens when you add hydrogen to the cup? In a second container, combine a few ounces of water with a couple of drops of your food coloring of choice. What happens when you add the food coloring to water? Does it mix? (to find out more about this, try the lava lamp experiment) Pour the colored water mixture into the hydrogen peroxide. What do you observe when you mix water and hydrogen? Any changes in color, temperature, or gasses released? These are all evidence that a chemical reaction is taking place. Finally, pour a packet of instant yeast into the mixture and immediately begin to swirl. What do you observe now?

Questions:

Do you know what exothermic and endothermic reactions are? Break down the words: What is “exo”? Think “exo-skeleton” or “exit sign.” It means out. What is “endo”? Kind of sounds like “into” and that’s exactly what it means too. How about “thermic”? Have you ever used a thermometer? What did it measure? “Thermic” means related to heat.

What Should Happen:

The beaker will begin to foam and heat up. Pro tip: adding a few drops of dish soap to the liquid mixture before adding the instant yeast will create a more intense result!

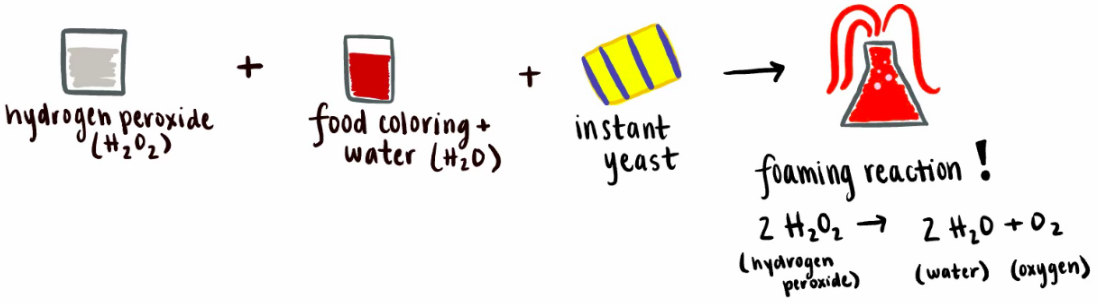
Why?

What is occurring is the chemical decomposition of hydrogen peroxide (H2O2) into → carbon dioxide gas (CO2) and water. This is known as an “exothermic” reaction, meaning heat is being released. The yeast acts as an enzymatic catalyst to speed up the decomposition reaction, hence the foaming.

Helpful links to follow:

- *“The Sci Guys: Science at Home - SE2 - EP13: Elephant Toothpaste”*
  - https://youtu.be/-RRTnIGr6fg
- *“Decomposition of Hydrogen Peroxide | Reactions | Chemistry | The Fuse School”*
  - https://youtu.be/R93BXXnkrRs
- *“Elephant Toothpaste Experiment & Recipe 3M”*
  - https://www.3m.com/3M/en_US/gives-us/education/science-at-home/elephant-toothpaste/

Elephant Toothpaste



$2\,H_2O_2 \rightarrow 2\,H_2O + O_2$

(hydrogen peroxide) (water) (oxygen)

DIY Lava Lamp

Materials needed:

- Container (plastic bottle/glass/etc.)
- Water
- Oil (vegetable/canola)
- Alka Seltzer tablet
- Food coloring

Methods:

Pour a couple ounces of water in a container. Add a few drops of food coloring of your choice. What happens when you add the food coloring to water? Does it mix? Next, fill the container/glass mostly full with canola or vegetable oil. What happens now? Does it mix with the water? How about the food coloring? Finally, drop in an alka seltzer tablet to the container. What do you observe when you mix water and hydrogen? Any changes in color, temperature, or gasses released? These are all evidence that a chemical reaction is taking place.

What Should Happen?

The alka seltzer will react to produce carbon dioxide (CO_2) gas and water, causing colored bubbles to float upwards in the glass. The oil and water will not mix.

Why?

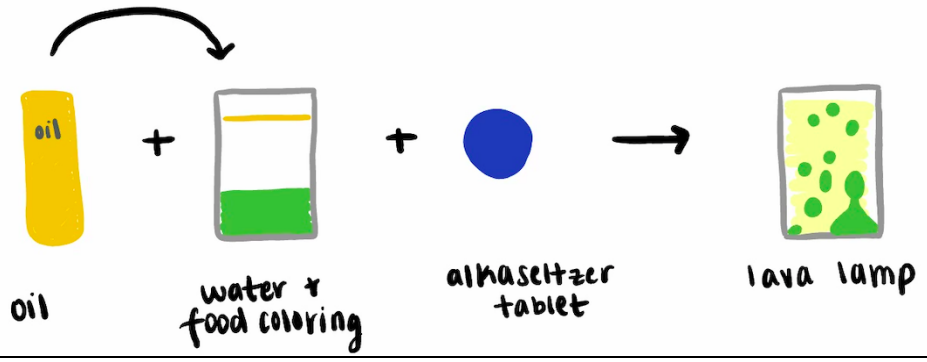
This is because of the "hydrophobic effect." Water molecules are polar, which means they have two ends that can repel or attract, like magnets*. This makes water stick together. Oil, on the other hand, is non-polar, so it acts kinda like dry sand. It doesn't like to stick together very much. The water is able to form the lava lamp bubbles because it's all stuck, while the oil lets it pass through. It's like sharks and minnows, but the sharks (oil) are really really bad at holding hands together, so the minnows (water) pass through easily.

Now, another property at work here is density. Think of a bag of feathers, and a same sized bag of beans. Which is heavier? Hint: It's the beans. That's because beans are denser, which means they have more weight in the same volume. They are more tightly packed in, if you will. The more dense a liquid is, the easier it will sink. In our experiment, water is denser than oil (because the molecules hold each other tighter), so it's on the bottom. All the alka seltzer does is create tiny air bubbles in the water that make it less dense than the oil, which makes it rise.

Helpful links to follow:

- *"How to Make a Lava Lamp at Home"*
  - https://youtu.be/qCuFjXGSVB4
- *"How Lava Lamps Are Made | The Making Of"*
  - https://youtu.be/Gs-cOlrvNwI
- *"Make an Alka-Seltzer Powered Lava Lamp"*
  - https://www.sciencebuddies.org/stem-activities/make-a-lava-lamp

DIY Lava Lamp



Floating Marbles

Materials needed:

- Plastic cup
- Water
- Play dough/clay
- Marbles

Methods:

Fill up your cup with water. Mark where the water is in the cup. Roll your clay into a ball, and place it in the cup. Did it sink? Did the water level change? Now drop the marbles in. Did they sink? Did the water level change? Carefully take out the marbles and the clay from the cup. Now, shape the clay into a bowl. Place it in the cup. Did it sink? Did the water level change? If so, how much compared to the clay ball? Add marbles to the center of the clay bowl, while still in the water. How many can you add? Do they stay afloat? How does the water level change?

What should happen?

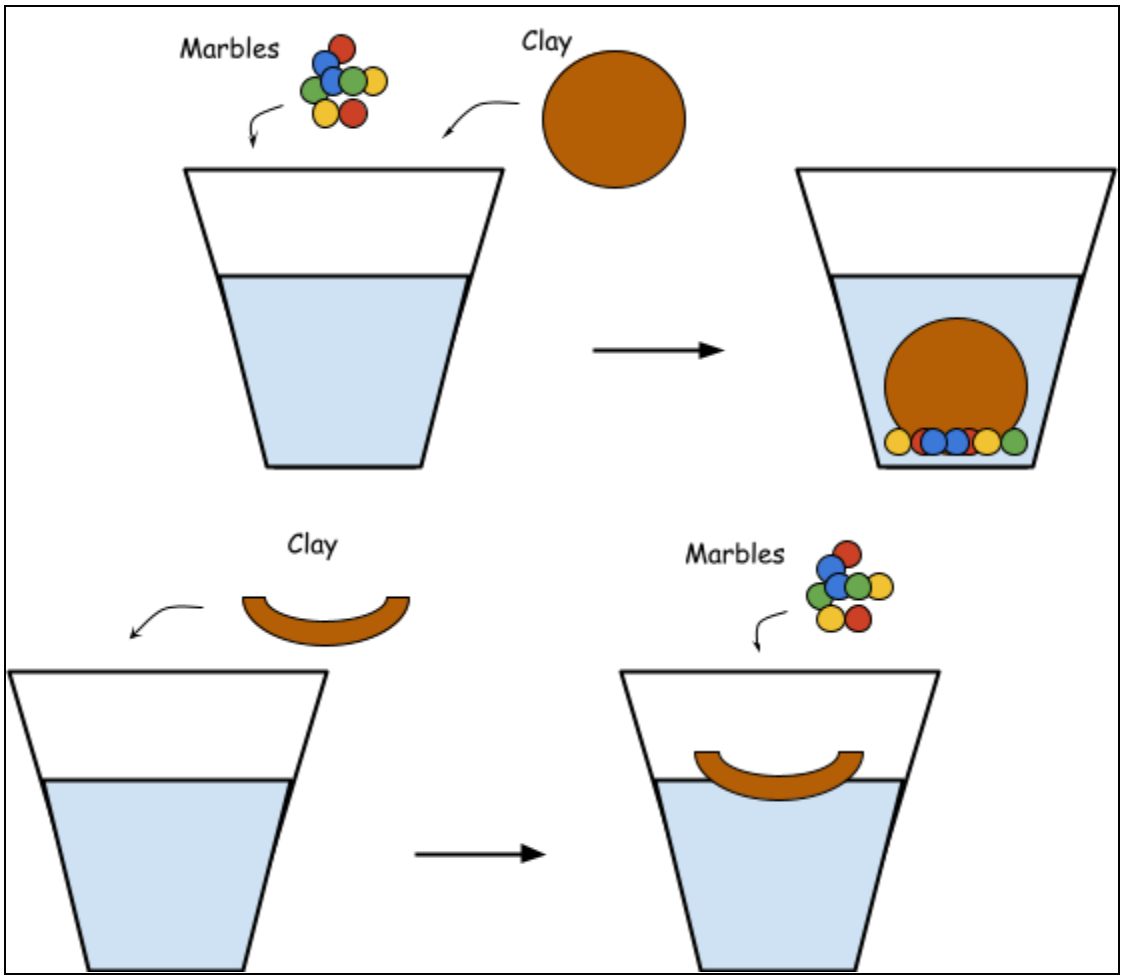
At first, the marbles and the clay ball should sink. They will raise the water level. Once the clay bowl is formed, however, it should float, and carry a cargo of the marbles before it sinks. It should raise the water level more.

Why?

This experiment deals with a property called "displacement of water," which basically means how much water is pushed away. When the clay is formed into bowl, it pushes away more water than when it's a ball (because it's "carrying air" so it's less dense), which pushes back (Newton's third law: every action has an equal and opposite reaction) and thus creates more force to keep the bowl afloat. This is why ships don't sink.

Helpful links to follow:

- https://www.britannica.com/video/181395/Discussion-forces-bodies-water#:~:text=When%20an%20object%20enters%20water,when%20we%20take%20a%20bath.
- https://www.youtube.com/watch?v=2RefIvqaYg8


Marbles
Clay
Clay
Marbles

Oxygen Leaves

Materials needed:

- Jar
- Water
- Leaf (gather outside or use a spinach leaf)
- A piece of fabric
- Magnifying glass (optional)

Methods:

Fill your jar with water and put the leaf in it. Place the jar outside and wait about an hour. Look carefully at the leaf with your eyes or using a magnifying glass. Do you see any changes? Pour the water out and take the leaf out. Fill your jar with water again and put a new leaf in it. Place the jar outside, but this time, cover it up with a piece of fabric (a T-shirt, or aluminum foil) and wait about an hour. Do you see any changes?

What should happen?

The first time, you should see lots of tiny bubbles on the leaf. The covered jar, on the other hand, should have no, or very little, bubbles on the leaf.

Why?

As the sun hits the leaf, it goes through a process called photosynthesis, where it uses sunlight, water, and CO2 in the air to make oxygen and sugar (glucose). The oxygen is the bubbles you can see on the leaf!

Helpful links to follow:

- https://www.khanacademy.org/science/ap-biology/cellular-energetics/photosynthesis/a/intro-to-photosynthesis
- https://www.youtube.com/watch?v=7mHS_86VVeg
- https://www.youtube.com/watch?v=sQK3Yr4Sc_k
- And for those interested, here's a college level biochemical explanation: https://www.youtube.com/watch?v=dAF5FngVa7A